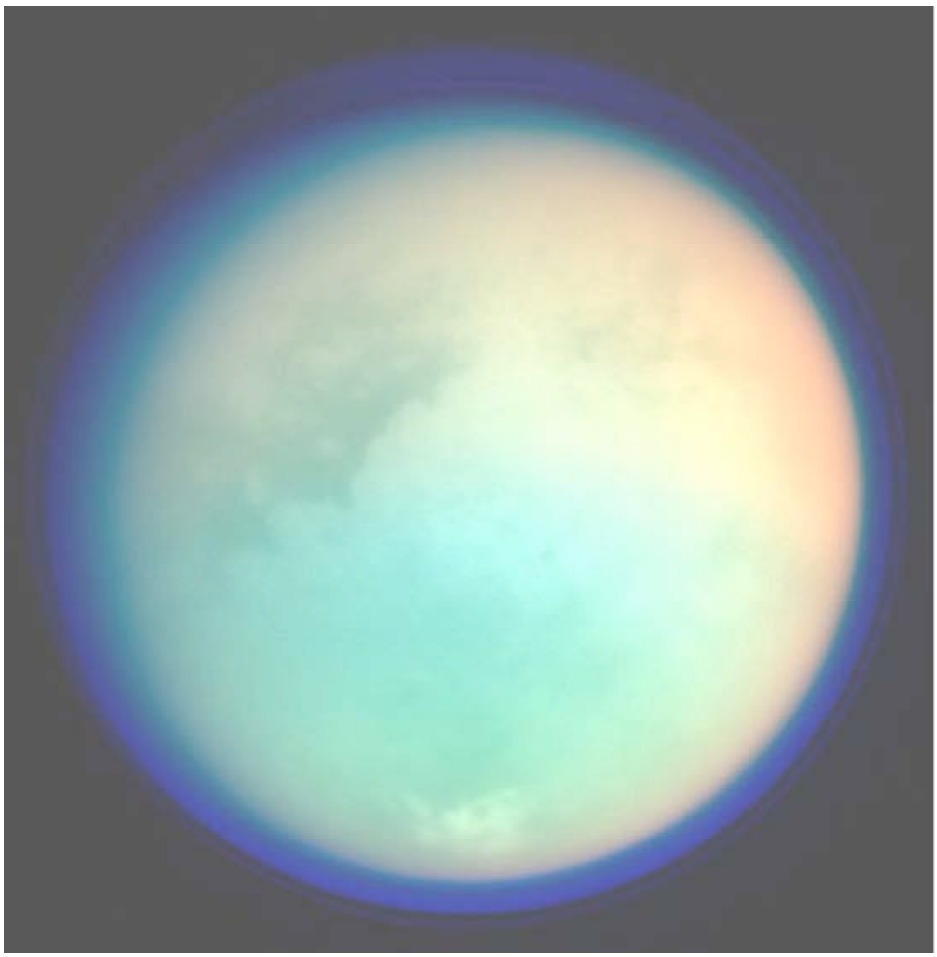
C A S S I N I



T I T A N - B
MISSION DESCRIPTION

December 2004

Jet Propulsion Laboratory
California Institute of Technology

PD 699-100, Rev O (supplement)
JPL D-5564, Rev O (supplement)
JPL CL#04-3899, Rev. 1 (Last Update: 12/1/04)

1.0 OVERVIEW

The second targeted flyby of Titan occurs on Monday, December 13, 2004 at 11:38 SCET (03:38 am Pacific time). Cassini's closest approach to Saturn's largest satellite is at an altitude of 1200 km (746 miles) above the surface at a speed of 6.1 kilometers per second (14,000 mph). Titan has a diameter of 5150 km (3200 miles), so the spacecraft passes within 1.5 Titan radii.

This encounter is set up with two maneuvers: an apoapsis maneuver scheduled for November 20th, and a Titan approach maneuver, scheduled for December 9th. Titan B is an inbound flyby, with Saturn periapsis occurring about two days afterwards, on December 15th. The Navigation team expects to deliver the orbiter to within 30 km of the target altitude at a confidence of 99% (three sigma).

Titan B is Cassini's third targeted satellite encounter. The first was Phoebe, on June 11th, at an altitude of 2000 km. The second was Titan A, on October 26th, at an altitude of 1174 km.

The Titan-B flyby requires the use of the live update capability to update the pointing vectors.

1.1 ABOUT TITAN

Titan is one of the primary scientific interests of the Cassini-Huygens mission. Through observations by Earth based telescopes and the Voyager spacecraft, Titan has been revealed to be an intriguing world both similar in nature to Earth and unique among both satellites and terrestrial planets. The largest of Saturn's satellites, Titan is larger than the planets Mercury or Pluto. Titan is the only satellite in the solar system with an appreciable atmosphere. Like Earth's atmosphere, Titan's atmosphere is composed mostly of Nitrogen, yet appears to have few clouds. However, it also contains significant quantities of aerosols and organic compounds (hydrocarbons), including methane and ethane. Although Titan's thick smoggy atmosphere masks its surface, scientists have speculated Titan's surface could contain solid, liquid and muddy material creating features such as lakes, seas, or rivers. Additionally liquid reservoirs may exist beneath the surface forming geysers or volcanoes that feed flowing liquid onto the surface.

Titan's peak surface temperature is about 95 Kelvins, too cold for liquid water, and due to its thick atmosphere, the pressure at the surface is 1.6 times greater than Earth's atmosphere. At this temperature and pressure, chemicals such as methane, ethane, propane, ammonia, water-ice and acetylene may be involved in complex interior-surface-atmosphere chemical cycles resulting in eruptions, condensation and precipation (or rain). Initial observations obtained by Cassini during the first two passes of Titan provided our first close up views of Titan in wavelengths ranging from visible light to infrared to radar. The results show a mysterious world even more complex than previously thought. The status of liquids on the surface is still unclear and the diversity of surface composition and its connection to Titan's geologic features remains a fundamental question. Clouds in Titan's atmosphere were observed in the southern hemisphere, yet no clear explanation has emerged on what the clouds are composed of, or why more clouds do not exist. Observations of Titan's interaction with Saturn's magnetosphere indicates the presence of complex processes complicated by Titan's occasional emergence out of Saturn's magnetosphere into the solar wind.

Observations by the Cassini orbiter during Tb will provide critical information to our understanding of Titan. New infrared and visible measurements will help to understand the relationship between features seen in the visible and radar wavelength images and surface composition. Ultraviolet occultations and infrared spectrometry will help

understand the complexity of Titan's atmosphere important to understanding its origin and evolution. The new observations will offer the first detailed investigation of the variability on Titan, both in its atmosphere and across its surface. Are there volcanoes or geysers? Is there evidence for flowing liquids on the surface? What is the extent of weather on Titan? How does Titan's upper atmosphere react to the variability of Saturn's magnetosphere? The variations of Titan's surface, atmosphere and magnetosphere are clues to the active processes dictating its evolution and the origin of its intriguing complexity.

1.2 TITAN-B SCIENCE ACTIVITIES

The Cassini/Huygens project is interested in four broad science themes concerning Titan: its interior stucture, surface characteristics, atmospheric properties, and interaction with Saturn's magnetosphere.

Titan B will provide further constraints on the density of Titan's atmosphere. This will contribute significantly to atmospheric modeling necessary to validate the lower flyby altitudes for future passes (and perhaps the Huygens mission profile as well). The sources of this improvement will come primarily from UVIS atmospheric occultation data and AACS attitude control telemetry during the flyby.

CAPS will make measurements of Titan's upper ionosphere and gather science from Cassini's crossing through Titan's plasma wake. They will make both ion and electron measurements during the flyby. The recent trajectory shift due to Iapetus has caused Titan B to be geometrically similar to Titan A. This gives CAPS and other teams an excellent opportunity to look for time variability, as well as getting more/better data on all of their goals from Titan A.

CIRS will perform a 2-hr limb integration using their mid-IR detectors to search for new molecules in the stratosphere. They will also continue their campaign of far-IR integrations (begun on T0) to search for species at longer wavelengths, and obtain a thermal map of the stratosphere, lending insight into the dynamics of Titan's atmosphere.

For ISS, TB provides opportunities for imaging at high-resolution (pixel scales as small as a few 10s of m) and low-phase angles (as low as 16 degrees). ISS observations include the Huygens' landing site (designed to allow stereo coverage with T10) and the locations of the specular points during both TA and TB. Outbound ride-along observations with VIMS may provide views of Titan's north polar region illuminated by Saturn-shine.

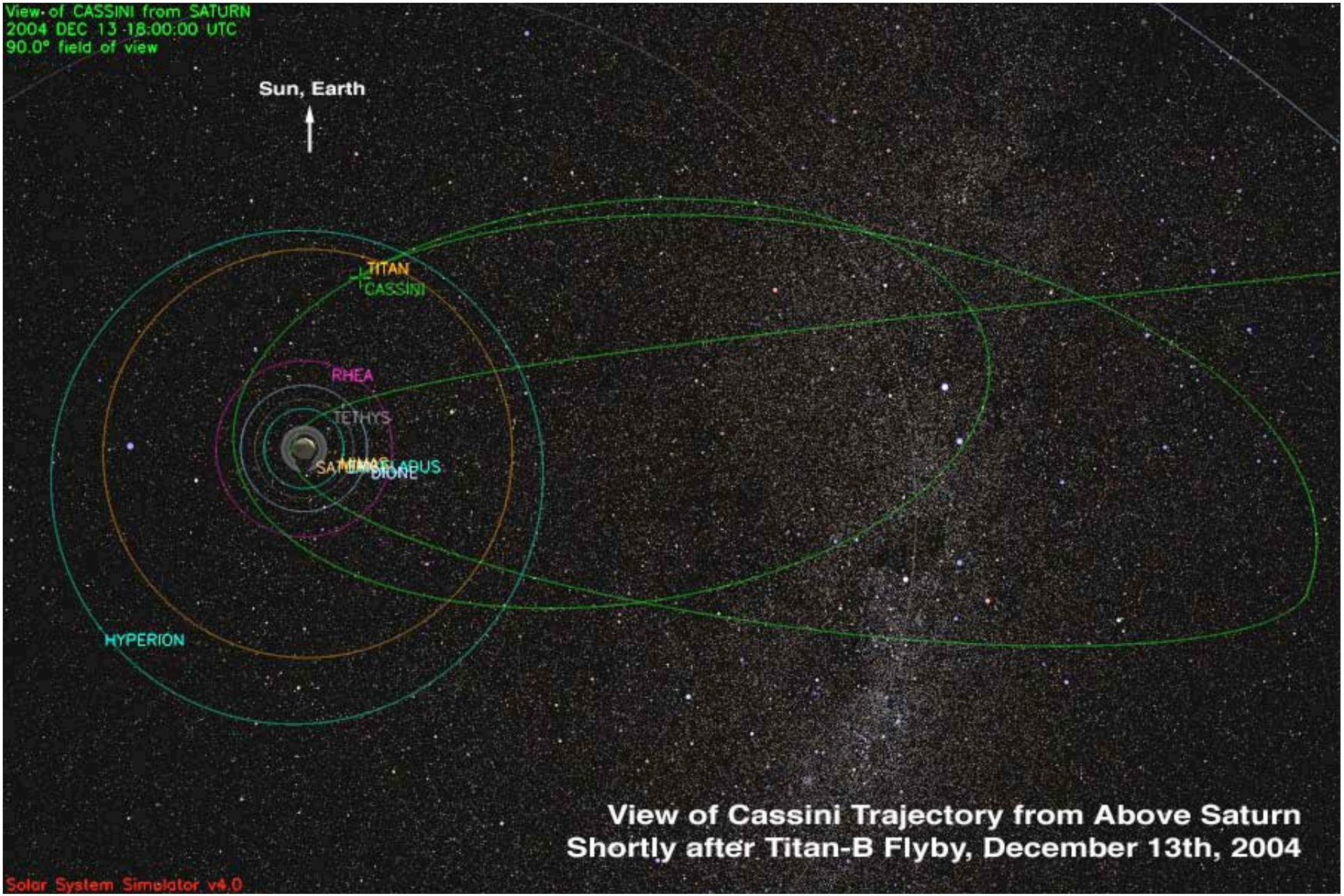
MAG will study the influence of the incident plasma flow on the highly dynamic outer magnetosphere.

MIMI will examine Titan's exosphere with ENA imaging and characterize the ion composition and charge state near Titan.

RPWS will measure the density and temperature of Titan's ionospheric electrons, look for evidence of ion pickup processes as part of the magnetosphere–Titan interaction, look for radio emissions from Titan, and search for lightning in Titan's ionosphere.

UVIS will observe two stellar occultations which will tell us about the vertical profile of methane gas in Titan's high atmosphere. This will provide constraints on the density of the atmosphere. This is valuable for science and also for establishing the safety issues for low passes later in the tour.

VIMS will perform observations of the surface of Titan at small solar phase angles, and investigate the formation and evolution of clouds on Titan. They will also search for lightning and hot spots and will attempt airglow characterization.


View of CASSINI from SATURN
2004 DEC 13 18:00:00 UTC
90.0° field of view
Sun, Earth
TITAN
CASSINI
RHEA
TETHYS
DIONE
HYPERION
View of Cassini Trajectory from Above Saturn
Shortly after Titan-B Flyby, December 13th, 2004
Solar System Simulator v4.0

Cassini Titan-B Timeline - December 2004

Colors: yellow = maneuvers; blue = geometry; pink = Tb-related; green = data playbacks

Orbiter UTC	Ground UTC	Pacific Time	Time wrt Tb	Activity	Description
320T07:49	Nov 15 08:57	Mon Nov 15 12:57 AM	Tb-28d04h	Start of S06 background sequence	Start of 31-day sequence which contains Titan-B flyby
344T21:06	**Dec 09 22:14**	Thu Dec 09 02:14 PM	Tb-03d15h	**OTM #7 TB Approach**	**Titan-B minus three day targeting maneuver**
345T21:05	**Dec 10 22:13**	Fri Dec 10 02:13 PM	Tb-02d15h	**OTM #7 Backup**	
345T08:03	Dec 10 09:11	Fri Dec 10 01:11 AM	Tb-03d04h	**ISS Titan movie**	15 images of Titan every hour for 12 hours.
345T20:10	Dec 10 21:18	Fri Dec 10 01:18 PM	Tb-02d15h	Turn to Earth-line	
345T21:05	Dec 10 22:13	Fri Dec 10 02:13 PM	Tb-02d15h	9.5 hr playback	Madrid 34m pass
346T07:48	Dec 11 08:56	Sat Dec 11 12:56 AM	Tb-02d04h	Turn cameras back to Titan	Max turn time = 14 minutes
346T08:03	Dec 11 09:11	Sat Dec 11 01:11 AM	Tb-02d04h	**ISS Titan movie**	15 images of Titan every hour for 15 hours
347T00:00	Dec 12 01:08	Sat Dec 11 05:08 PM	Tb-01d12h	ISS ring observation	Radial color scan of rings
347T03:45	Dec 12 04:53	Sat Dec 11 08:53 PM	Tb-01d08h	Turn to Earth-line	
347T04:36	Dec 12 05:44	Sat Dec 11 09:44 PM	Tb-01d07h	9 hr playback to empty both SSRs	1h41m to Madrid 70m, then 7h19m to Goldstone 70m
347T13:36	Dec 12 14:44	Sun Dec 12 06:44 AM	Tb-22h02m	Turn cameras back to Titan	
347T14:57	Dec 12 16:05	Sun Dec 12 08:05 AM	Tb-20h41m	Dead time	15 minutes long; used to accommodate changes in flyby time
347T15:13	Dec 12 16:21	Sun Dec 12 08:21 AM	Tb-20h25m	Begin low to medium resolution obs	Mid and Far IR CIRS observations and med res imaging
348T03:38	Dec 13 04:46	Sun Dec 12 08:46 PM	Tb-08h00m	Several slow scans across Titan	Spectral imaging
348T07:38	Dec 13 08:46	Mon Dec 13 12:46 AM	Tb-04h00m	Begin regional map / high resolution	
348T11:08	Dec 13 12:16	Mon Dec 13 04:16 AM	Tb-00h30m	Transition to thrusters	Duration = 21 minutes
348T11:29	Dec 13 12:37	Mon Dec 13 04:37 AM	Tb-00h09m	Turn UVIS to Alpha Vir & Lambda Sco	Atmospheric occultations until 12:28
348T11:38	Dec 13 12:46	Mon Dec 13 04:46 AM	Tb+00h00m	**Titan-B flyby closest approach**	**Altitude = 1200 km (746 miles), speed = 6.1 km/s (14,000 mph); low phase inbound, 101 deg phase at closest approach, high phase outbound**
348T12:05	Dec 13 13:13	Mon Dec 13 05:13 AM	Tb+00h27m	Transition back to reaction wheels	Duration = 24 minutes
348T12:28	Dec 13 13:36	Mon Dec 13 05:36 AM	Tb+00h50m	Dark side observations of Titan	Search for and monitor lightning/aurora
348T13:34	Dec 13 14:42	Mon Dec 13 06:42 AM	Tb+01h56m	**Ascending Ring-Plane Crossing**	
348T16:38	Dec 13 17:46	Mon Dec 13 09:46 AM	Tb+05h00m	Titan limb observations	Search for trace constituents in Titan's strato
348T22:08	Dec 13 23:16	Mon Dec 13 03:16 PM	Tb+10h30m	Dead time	15 minutes long; used to accommodate changes in flyby time
348T22:23	Dec 13 23:31	Mon Dec 13 03:31 PM	Tb+10h45m	Turn to Earth-line	Max turn time = 29 minutes
348T22:52	Dec 14 00:00	Mon Dec 13 04:00 PM	Tb+11h14m	**Begin playback of Titan-B data**	**Madrid 70m pass; critical UVIS data first**
349T07:52	Dec 14 09:00	Tue Dec 14 01:00 AM	Tb+20h14m	**End playback of Titan-B data**	**(See Playback Timeline)**
350T01:44	Dec 15 02:52	Tue Dec 14 06:52 PM	Tb+01d14h	Dione closest approach (72,500km)	Non-targeted
350T05:52	Dec 15 07:00	Tue Dec 14 11:00 PM	Tb+01d18h	Saturn periapse	Closest approach to Saturn, at 4.8 Saturn radii, 108 deg phase
350T11:04	Dec 15 12:12	Wed Dec 15 04:12 AM	Tb+01d23h	**Descending ring-plane crossing**	5.8 radii from Saturn; cross through center of E ring

Last Updated: 12/1/04 - Subject to change.
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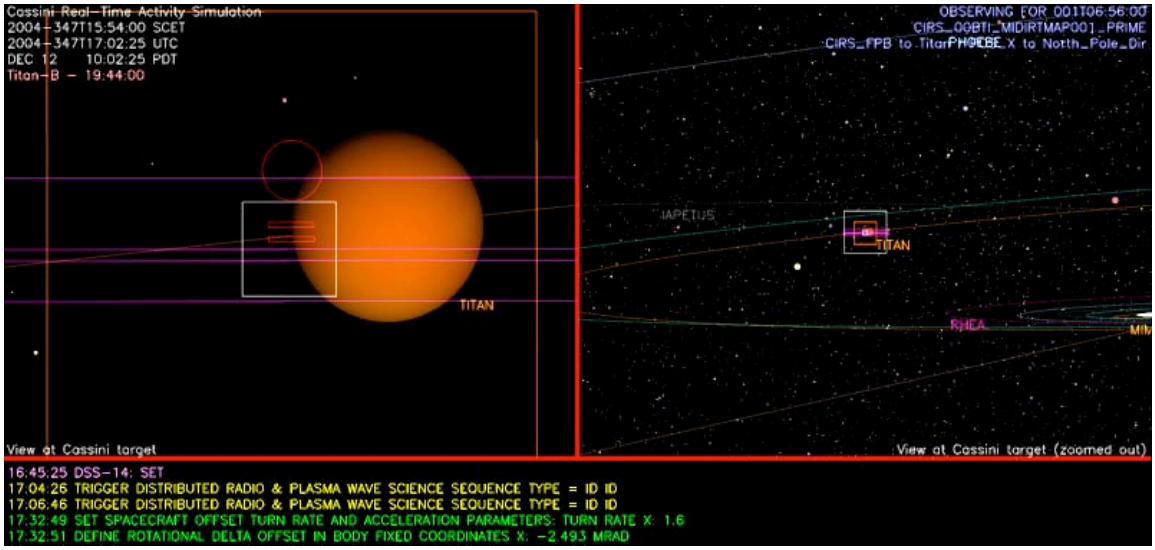
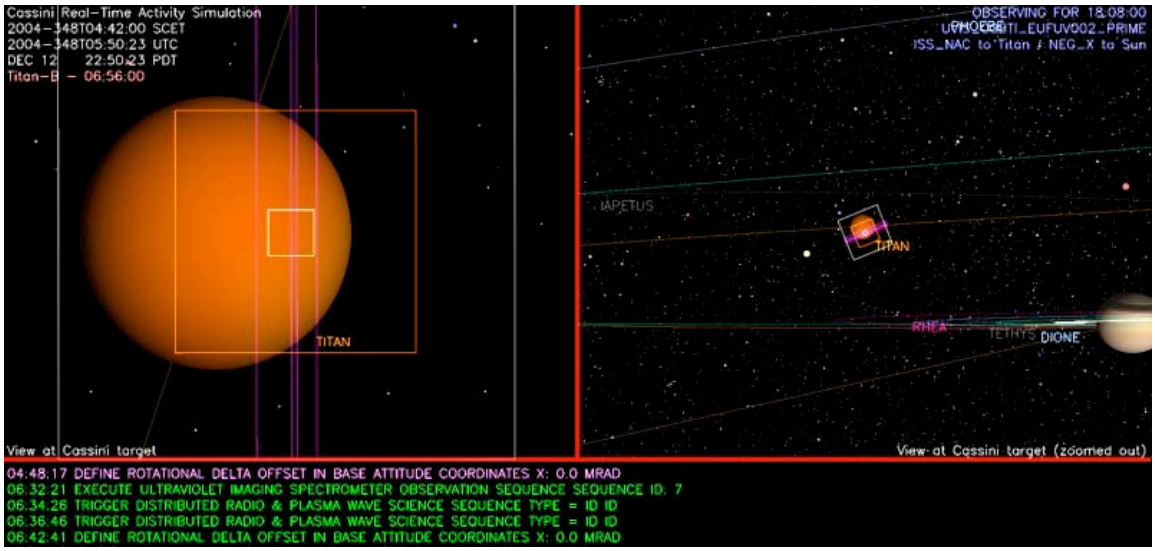
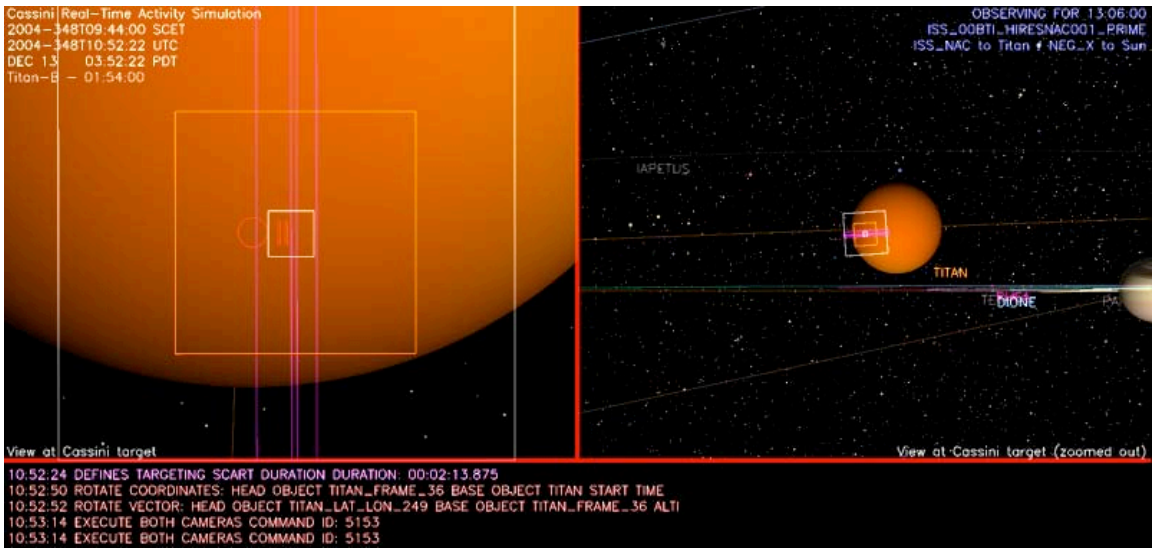
Ground UTC is the time when the signal reaches Earth. It takes about 1 hour and 8 minutes for the signal to travel from the spacecraft to Earth.

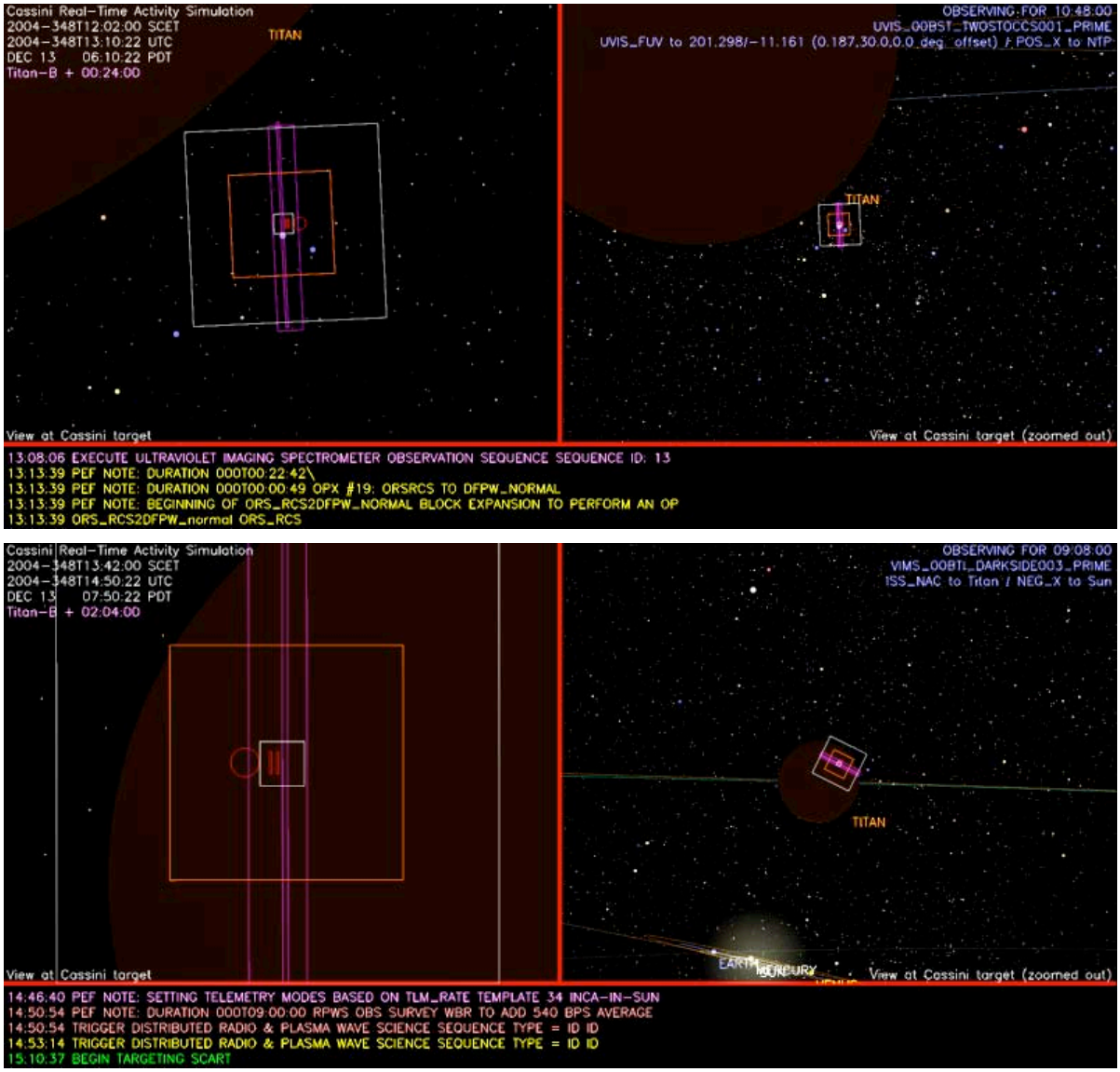
1.3 TITAN-B SEQUENCE OF EVENTS AND SAMPLE SNAPSHOTS

The surrounding pages list the Tb sequence of events and sample snapshots.









1.4 TB DATA RECORDING AND PLAYBACK

The Titan-B data recording and playback strategy is the same as the nominal tour strategy, with one notable exception. UVIS stellar occultation and AACS data collected near closest approach will be rerouted to partition 5 which will be played back at the start of the Madrid 70m pass, and then played back again over both the Madrid and Goldstone 70m stations near the end of the pass. This was done to further ensure successful playback since the UVIS data contributes to the knowledge of the Titan atmosphere which governs the minimum Titan flyby altitude acceptable for future flybys and for the Huygens Probe mission.

A time ordered description of the data playback is shown on the following pages. The SSR is nearly filled during the flyby with a total of 3.5 Gbit of data. Playback begins on December 13 (DOY 348) at 22:52 (SCET) and completes on December 14 at 07:52. Dual playback to both Madrid and Goldstone takes place during the last 45 minutes of the downlink (07:07-07:52 SCET).

One-way light time at the time of the encounter is 1 hour and 8 minutes.

Titan Tb Approximate Playback Timeline

Event or Observation	Observation Type (AGPEN)	Observation Record Start Time (SCET)	Start Playback of Downlink Event (Monday is 2004-348, Dec. 13)		
			Orbiter UTC	Ground UTC	Pacific Time
BEGIN P5 Playback of Critical UVIS Data			Mon 10:52 PM	Tue 12:00 AM	Mon 04:00 PM
BEGIN A4 Playback			Mon 11:02 PM	Tue 12:10 AM	Mon 04:10 PM
CDA_00BDR_SURVEY005_RIDER	CDA_524	2004-345T07:52:00	Mon 11:02 PM	Tue 12:10 AM	Mon 04:10 PM
CAPS_00BSA_SURVEY001_RIDER	CAPS_16000	2004-345T11:00:00	Mon 11:02 PM	Tue 12:10 AM	Mon 04:10 PM
INMS_00BSA_PSTOTM7BU001_RIDER	INMS_1498	2004-346T06:05:00	Mon 11:02 PM	Tue 12:10 AM	Mon 04:10 PM
MAG_00BOT_SURVEY008_PRIME	MAG_1976	2004-347T06:17:00	Mon 11:02 PM	Tue 12:10 AM	Mon 04:10 PM
MAG_00BOT_SURVEY009_PRIME	MAG_1976	2004-347T13:36:00	Mon 11:02 PM	Tue 12:10 AM	Mon 04:10 PM
MIMI_00BCO_SURVEY006_RIDER	MIMI_8000	2004-347T04:21:00	Mon 11:02 PM	Tue 12:10 AM	Mon 04:10 PM
RPWS_00BSA_OUTSURVEY004_PRIME	RPWS_30464	2004-347T04:21:00	Mon 11:02 PM	Tue 12:10 AM	Mon 04:10 PM
RPWS_00BSA_OUTSURVEY007_PRIME	RPWS_30464	2004-347T07:17:00	Mon 11:02 PM	Tue 12:10 AM	Mon 04:10 PM
UVIS_00BSW_IPHSURVEY052_RIDER	UVIS_5032	2004-347T04:36:00	Mon 11:02 PM	Tue 12:10 AM	Mon 04:10 PM
CIRS_00BTI_MIDIRTMAP001_PRIME	CIRS_4000	2004-347T15:13:13	Mon 11:06 PM	Tue 12:14 AM	Mon 04:14 PM
ISS_00BTI_MIDIRTMAP001_CIRS	ISS_Phot_1_by_1	2004-347T15:13:13	Mon 11:06 PM	Tue 12:14 AM	Mon 04:14 PM
VIMS_00BTI_MIDIR005_CIRS	VIMS_18432	2004-347T15:13:13	Mon 11:06 PM	Tue 12:14 AM	Mon 04:14 PM
CIRS_00BTI_FIRNADCMP001_PRIME	CIRS_4000	2004-347T23:38:13	Mon 11:39 PM	Tue 12:47 AM	Mon 04:47 PM
INMS_00BTI_TBINBD001_RSS	INMS_1498	2004-347T23:38:13	Mon 11:39 PM	Tue 12:47 AM	Mon 04:47 PM
ISS_00BTI_FIRNADCMP001_CIRS	ISS_Phot_1_by_1	2004-347T23:38:13	Mon 11:39 PM	Tue 12:47 AM	Mon 04:47 PM
CIRS_00BTI_FIRNADMAP001_UVIS	CIRS_4000	2004-348T03:38:13	Tue 12:15 AM	Tue 01:23 AM	Mon 05:23 PM
ISS_00BTI_EUFUV002_UVIS	ISS_Phot_1_by_1	2004-348T03:38:13	Tue 12:15 AM	Tue 01:23 AM	Mon 05:23 PM
UVIS_00BTI_EUFUV002_PRIME	UVIS_5032	2004-348T03:38:13	Tue 12:15 AM	Tue 01:23 AM	Mon 05:23 PM
VIMS_00BTI_EUVFUV004_UVIS	VIMS_18432	2004-348T03:38:13	Tue 12:15 AM	Tue 01:23 AM	Mon 05:23 PM
CIRS_00BTI_FIRNADMAP003_ISS	CIRS_4000	2004-348T07:38:13	Tue 01:00 AM	Tue 02:08 AM	Mon 06:08 PM
ISS_00BTI_REGMAP001_PRIME	ISS_Phot_1_by_1	2004-348T07:38:13	Tue 01:00 AM	Tue 02:08 AM	Mon 06:08 PM
VIMS_00BTI_HIRES004_ISS	VIMS_18432	2004-348T07:38:13	Tue 01:00 AM	Tue 02:08 AM	Mon 06:08 PM
CAPS_00BTI_TBINBND001_RIDER	CAPS_16000	2004-348T09:38:13	Tue 01:27 AM	Tue 02:35 AM	Mon 06:35 PM
ISS_00BTI_HIRESNAC001_PRIME	ISS_Phot_1_by_1	2004-348T09:38:13	Tue 01:27 AM	Tue 02:35 AM	Mon 06:35 PM
MAG_00BTI_MAGTITAN001_PRIME	MAG_1976	2004-348T09:38:13	Tue 01:27 AM	Tue 02:35 AM	Mon 06:35 PM
MIMI_00BTI_TBINBND001_RIDER	MIMI_8000	2004-348T09:38:13	Tue 01:27 AM	Tue 02:35 AM	Mon 06:35 PM
RPWS_00BTI_TIINTRMED001_PRIME	RPWS_30464	2004-348T09:38:13	Tue 01:27 AM	Tue 02:35 AM	Mon 06:35 PM
CAPS_00BTI_TBCLOSE001_RIDER	CAPS_16000	2004-348T10:38:13	Tue 02:24 AM	Tue 03:32 AM	Mon 07:32 PM
INMS_00BTI_TBCLOSE001_RSS	INMS_1498	2004-348T10:38:13	Tue 02:24 AM	Tue 03:32 AM	Mon 07:32 PM
MIMI_00BTI_TBCLOSE001_RIDER	MIMI_8000	2004-348T10:38:13	Tue 02:24 AM	Tue 03:32 AM	Mon 07:32 PM
BEGIN A4 Playback of D/L Science & Engr.			Tue 02:26 AM	Tue 03:34 AM	Mon 07:34 PM
ISS_00BSC_ORSRCS348_ENGR	ISS_Phot_1_by_1	2004-348T11:08:13	Tue 02:35 AM	Tue 03:43 AM	Mon 07:43 PM
RPWS_00BTI_TICA001_PRIME	RPWS_182784	2004-348T11:08:13	Tue 02:35 AM	Tue 03:43 AM	Mon 07:43 PM

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Titan Tb Approximate Playback Timeline

Event or Observation	Observation Type (AGPEN)	Observation Record Start Time (SCET)	Start Playback of Downlink Event (Monday is 2004-348, Dec. 13)		
			Orbiter UTC	Ground UTC	Pacific Time
BEGIN B4 Playback			Tue 02:39 AM	Tue 03:47 AM	Mon 07:47 PM
UVIS_00BST_TWOSTOCCS001_PRIME	UVIS_32096	2004-348T11:29:13	Tue 03:21 AM	Tue 04:29 AM	Mon 08:29 PM
UVIS_00BST_TWOSTOCCS002_RIDER	UVIS_32096	2004-348T12:05:13	Tue 04:01 AM	Tue 05:09 AM	Mon 09:09 PM
RPWS_00BTI_TIINTRMED002_PRIME	RPWS_30464	2004-348T12:08:13	Tue 04:04 AM	Tue 05:12 AM	Mon 09:12 PM
CIRS_00BTI_FIRLMBAER002_VIMS	CIRS_4000	2004-348T12:28:13	Tue 04:12 AM	Tue 05:20 AM	Mon 09:20 PM
ISS_00BTI_DARKSIDE003_VIMS	**ISS_Phot_1_by_1**	**2004-348T12:28:13**	**Tue 04:12 AM**	**Tue 05:20 AM**	**Mon 09:20 PM**
VIMS_00BTI_DARKSIDE003_PRIME	VIMS_18432	2004-348T12:28:13	Tue 04:12 AM	Tue 05:20 AM	Mon 09:20 PM
CAPS_00BTI_TBOUTBND001_RIDER	CAPS_16000	2004-348T12:38:13	Tue 04:15 AM	Tue 05:23 AM	Mon 09:23 PM
INMS_00BTI_TBOUTBD001_RSS	**INMS_1498**	**2004-348T12:38:13**	**Tue 04:15 AM**	**Tue 05:23 AM**	**Mon 09:23 PM**
MIMI_00BTI_TBOUTBND001_RIDER	**MIMI_8000**	**2004-348T12:38:13**	**Tue 04:15 AM**	**Tue 05:23 AM**	**Mon 09:23 PM**
CAPS_00BSA_SURVEY003_RIDER	CAPS_16000	2004-348T13:38:13	Tue 04:28 AM	Tue 05:36 AM	Mon 09:36 PM
MAG_00BOT_SURVEY001_PRIME	MAG_1976	2004-348T13:38:13	Tue 04:28 AM	Tue 05:36 AM	Mon 09:36 PM
MIMI_00BCO_SURVEY002_RIDER	**MIMI_8000**	**2004-348T13:38:13**	**Tue 04:28 AM**	**Tue 05:36 AM**	**Mon 09:36 PM**
RPWS_00BSA_OUTSURVEY006_PRIME	RPWS_30464	2004-348T13:38:13	Tue 04:28 AM	Tue 05:36 AM	Mon 09:36 PM
CIRS_00BTI_FIRNADMAP002_UVIS	CIRS_4000	2004-348T14:08:13	Tue 04:32 AM	Tue 05:40 AM	Mon 09:40 PM
ISS_00BTI_EUVFUV001_UVIS	**ISS_Phot_1_by_1**	**2004-348T14:08:13**	**Tue 04:32 AM**	**Tue 05:40 AM**	**Mon 09:40 PM**
UVIS_00BTI_EUVFUV001_PRIME	UVIS_5032	2004-348T14:08:13	Tue 04:32 AM	Tue 05:40 AM	Mon 09:40 PM
CIRS_00BTI_MIRLMBINT002_PRIME	CIRS_4000	2004-348T16:38:13	Tue 04:46 AM	Tue 05:54 AM	Mon 09:54 PM
ISS_00BTI_MIRLMBINT002_CIRS	**ISS_Phot_1_by_1**	**2004-348T16:38:13**	**Tue 04:46 AM**	**Tue 05:54 AM**	**Mon 09:54 PM**
VIMS_00BTI_MIDIR004_CIRS	VIMS_18432	2004-348T16:38:13	Tue 04:46 AM	Tue 05:54 AM	Mon 09:54 PM
CIRS_00BTI_FIRNADCMP002_VIMS	CIRS_4000	2004-348T18:38:13	Tue 05:02 AM	Tue 06:10 AM	Mon 10:10 PM
ISS_00BTI_DARKSIDE004_VIMS	**ISS_Phot_1_by_1**	**2004-348T18:38:13**	**Tue 05:02 AM**	**Tue 06:10 AM**	**Mon 10:10 PM**
VIMS_00BTI_DARKSIDE004_PRIME	VIMS_18432	2004-348T18:38:13	Tue 05:02 AM	Tue 06:10 AM	Mon 10:10 PM
UVIS_00BSW_IPHSURVEY053_RIDER	UVIS_5032	2004-348T22:52:00	Tue 05:42 AM	Tue 06:50 AM	Mon 10:50 PM
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BEGIN P5 Playback of Critical UVIS Data			Tue 07:12 AM	Tue 08:20 AM	Tue 12:20 AM
END P5 Playback			Tue 07:17 AM	Tue 08:25 AM	Tue 12:25 AM
BEGIN B4 Playback of D/L Science & Engr. (cont.)			Tue 07:17 AM	Tue 08:25 AM	Tue 12:25 AM
END DOWNLINK			Tue 07:52 AM	Tue 09:00 AM	Tue 01:00 AM

Created Nov. 13, 2004

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